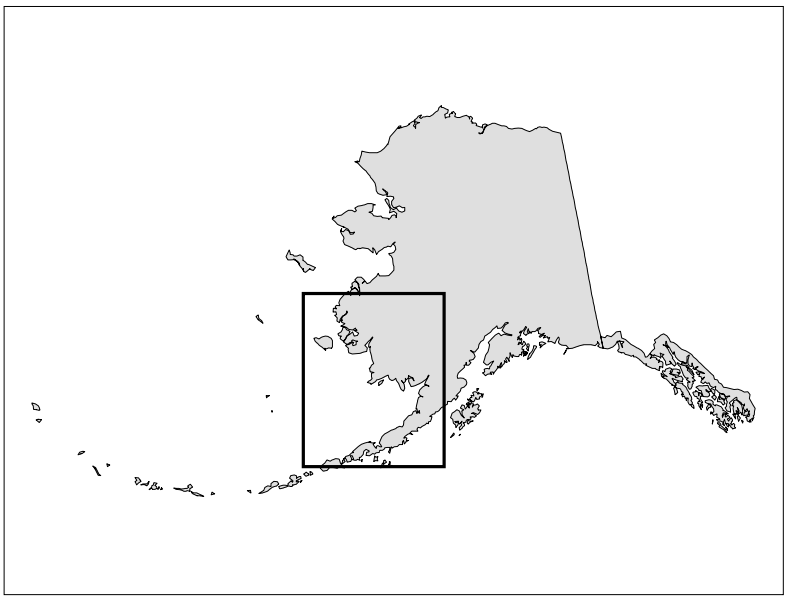
STELLER'S EIDER SPRING MIGRATION SURVEYS
SOUTHWEST ALASKA
2003



by:
William W. Larned

U.S. Fish and Wildlife Service
Migratory Bird Management Office
Waterfowl Branch - Anchorage, Alaska
June 5, 2003

STELLER'S EIDER SPRING MIGRATION SURVEYS, 2003

by
William W. Larned
U.S. Fish and Wildlife Service,Waterfowl Management,
43655 KBeach Rd., Soldotna, Alaska 99669.

Abstract. Annual spring aerial surveys were initiated in 1992, and repeated in 1993, 1994, 1997, 1998, 2000, 2001, 2002, and 2003 to monitor the population status of and habitat use by Steller's eiders (*Polysticta stelleri)* migrating northward in southwestern Alaska. Since the timing of migration varies, two to three replicate shoreline surveys were conducted each spring through 1997, to increase the probability of encountering the entire population of eiders as they transited the survey area en route to their arctic breeding grounds. Fiscal constraints and inclement weather in subsequent years resulted in successful completion of only one survey per year, the timing of which was carefully scheduled using satellite sea ice imagery and other pertinent data. The 2003 survey was conducted 3/29 to 4/10. We made visual estimates of Steller's eiders and all other identifiable water birds and marine mammals. The design consisted of a shoreline census, visually estimating all Steller's eiders observed within all known Steller's eider habitat in the Study area. To enhance consistency, most flock estimates of Steller's eiders were made by the pilot/port side observer, who was present in every survey. Beginning in 2000, the shoreline census was supplemented by an extrapolated sample in four extensive shoal areas, only one of which contained Steller's eiders. In each year where multiple surveys were completed, the highest Steller's eider count was used as that year's population estimate. In 1998 a double-sample study using aerial photographs of 17 flocks indicated that we were underestimating flock size, further suggesting that the survey provides a minimal estimate with long-term trend determination as its primary quantitative product. In 2000, 2001, and 2002 our aerial photo sample was inadequate for such determination, but a small sample completed in 2003 suggested that we are still underestimating most large dense flocks. Annual estimates, uncorrected for observer bias and using unextrapolated data from sampled areas, are 137,904 in 1992; 88,636 in 1993; 107,589 in 1994; 90,269 in 1997, 84,459 in 1998, 68,956 in 2000, 58,231 in 2001, 54,191 in 2002, and 77,329 in 2003. Correcting recent estimates using extrapolated data from sampled areas, the totals are 72,953 for 2000, 60,656 for 2001, 56,704 for 2002, and 77,369 for 2003. We suspect that the low population estimates obtained from 2000 through 2002 were due in part to a portion of the eiders migrating northward during the survey, and thus not being observed by the survey crew. This was supported by satellite telemetry data which indicated migration within the study area during the survey of 2002. We therefore initiated the 2003 survey earlier than other years, hoping to encounter most eiders before they moved from Alaska Peninsula lagoons to Kuskokwim Bay and other more northerly habitats. The 2003 survey also happened to coincide with a weather system with persistent north winds, which we suspect discouraged any northward migration flights. Unexpanded long-term survey data indicate a 6.1 percent annual decline in migrating Steller's eiders ($R^2 = 0.72$), which we feel supports continuing the survey, even in the absence of a measure of survey precision. Patterns of habitat use by Steller's eiders and most other sea duck species during migration was similar among years, indicating important spring habitats. Maps illustrate survey route and distribution of Steller's eiders and other selected seaduck species within the survey area in 2003. Detailed distributional data are available for all observed species upon request.

Key Words: Steller's eider, *Polysticta stelleri*, king eider, *Somateria spectabilis*, migration, population, Aerial, survey, waterfowl, water birds, Bering Sea, Bristol Bay

INTRODUCTION

The majority of the world population of Steller's eiders migrates along the Bristol Bay coast of the Alaska Peninsula in the spring, crosses Bristol Bay toward Cape Pierce, then continues northward along the Bering Sea coast. Most then cross the Bering Strait to their breeding grounds in Siberia, with a smaller number continuing north to the Alaska north slope to breed (Gill et al. 1978). They linger en route to feed at the mouths of lagoons and other productive habitats. From 1981 to present, migrating Steller's eiders were estimated during spring aerial surveys of emperor geese conducted over coastal habitats from Cape Romanzof to and including both the north and south coasts of the Alaska Peninsula. Results of this effort indicate a decline in prebreeding Steller's eider populations during this period, but some of the large between-year fluctuations may be artifacts of survey timing, and a goose-oriented technique that is not optimal for eiders. Concern over apparent declines of eiders prompted the U.S. Fish and Wildlife Service to initiate surveys in 1992 to monitor the population of Steller's eiders that winters in Alaska waters. Since a comprehensive survey of the species is not currently feasible on its extensive and remote winter range, which includes the Aleutian islands, the Alaska Peninsula, and the western Gulf of Alaska including Kodiak and lower Cook Inlet, current surveys estimate their numbers as they stage during migration in Bristol Bay and the Yukon-Kuskokwim Delta. Objectives of the effort are:

1. Obtain an annual estimate of the prebreeding population of Steller's eiders that winter in Alaskan waters.

2. Document distribution of and habitats used by Steller's eiders during migration.

3. Provide additional information on Steller's eiders, such as indications of annual recruitment.

4. Describe populations and distributions of other migrating water birds and marine mammals, to the extent that doing so does not compromise the Steller’s eider objectives.

This report summarizes results and observations from the 2003 Steller's eider survey, with comparisons to earlier surveys.

STUDY AREA AND METHODS

The survey area included sea duck habitats along the coast of southwestern Alaska from Cape Romanzof on the Yukon-Kuskokwim Delta (Y-K Delta) to Chignik Bay on the south side of the Alaska Peninsula. Steller’s eiders are shallow feeders normally found close to shore and in shoals in lagoons, bays and occasionally offshore areas, in water less than 10m in depth. Our objective for coverage was to search adaptively to census all Steller’s eiders within the survey area, as well as the most important concentrations of other sea ducks. We flew a Cessna 206 amphibious airplane over near-shore waters at an airspeed of 90 to 100 kts (166 to 185 km/hr) and an altitude of 150 to 250 feet (46 to 76 m). Habitats within Lagoons and bays were covered using an adaptive contiguous search pattern, while exposed shorelines were surveyed using a single track parallel to the coast within 1 km of the shoreline. The effort required for comparable coverage among surveys varied somewhat, depending upon the aggregate of sightability factors, such as lighting, sea surface condition, and bird distribution. For the Kuskokwim Bay area, we felt we accomplished essentially complete coverage of the dense concentrations of Steller’s eiders south of Kipnuk, using a boundary line drawn around all eider locations from previous surveys,

displayed in a GIS map, as a guide. This line was displayed in our "moving map" navigation system in the aircraft. For the portion of the bay from the Kipnuk shoals to the shoreline north of Goodnews Bay we sampled using a "sawtooth" flight pattern. We also used this technique in some other offshore areas which contained few or no Steller's eiders but large numbers of other sea ducks (Figs. 1 and 2, units 1-4). For analysis, these areas were treated the same as the rest of the survey area before 2000, but in 2000 to 2003 we extrapolated within these areas using expansion factors calculated as: km^2 of survey area/(linear km of flight lines within the survey area * km transect width). This method renders population indices that account for portions of the survey area that are incompletely covered, but are not comparable to results before 2000, particularly for black scoters, white-winged scoters, long-tailed ducks, king eiders and Steller's eiders. For this reason Table 2 contains unextrapolated data for comparison with earlier surveys.

For geographic reference, the shoreline was historically divided into 126 numbered segments (Larned et al. 1994), most identical to those used for the annual spring emperor goose survey conducted by the U.S. Fish and Wildlife Service, Fairbanks. However, in 1997 we began using a global positioning system (GPS)/laptop computer data collection system which enabled us to electronically record our flight path and the precise location of each observation, so the segments were no longer used. This system, consisting of a laptop computer for each observer, connected by serial cable to the onboard GPS receiver, enabled observers to record observations directly into the laptops. A custom program developed by John Hodges (U.S. Fish and Wildlife Service, Migratory Bird Management, Juneau, AK) recorded our flight path and automatically linked GPS coordinates to each recorded observation. Later transcription , using another special program written by Hodges, produced ASCII data files wherein each line contained a species and number observation plus geographic coordinates, date, and time. We also recorded ancillary data, including tide stage (high, medium, low, unknown), ice cover in tenths, and sea condition (Beaufort Scale). These auxiliary data are included in separate fields within each line in the output file, but so far have not been included in any data analyses.

The Steller's eider total is considered a minimal population estimate because some birds may escape detection by the survey crew by moving northward during the periods between survey flights, while others may be outside the survey area (north or south) during the survey. While we strive diligently to minimize such errors, we have no way of detecting or measuring shifts that may occur during the survey. In some years we repeated the survey up to three times each year to bracket the spring migration period, using the highest count as that year's Steller's eider estimate. However, in 1998, 2000, 2001, 2002, and 2003 only one survey per year was flown. We intended to conduct 2 complete surveys in 2001 and 2002, but were unable due to extended periods of inclement weather. Another source of error is flock estimation bias. We have tried to help measure and account for this bias by taking a representative sample of oblique aerial photographs of flocks which we have also estimated, counting the birds in the photos, then using the resulting ratios to develop a correction factor with variance estimate. While we were moderately successful at this in 1998 (Larned 1998), normally the frequent and sequential diving behavior of Steller's eiders makes obtaining an adequate sample of photographs frustrating and time-consuming, and we have not been successful in this endeavor since 1998.

Our recorded flight path for the survey of 29 March through 11 April 2003 is displayed in figs. 1-4. Please note that, due to differences in timing of migration and habitat preferences among species, the coverage described above is not adequate for a complete census of other species within the survey area. Accordingly numeric results for these species are highly variable among years. General interpretive comments for survey results for selected species are included in the RESULTS section of the 1998 Steller's eider survey report (Larned 1998).

Table 1. Total flight hours for spring Steller's eider surveys, southwest Alaska, 1992-03.

Survey No.	1992	1993	1994	1997	1998	2000	2001	2002	2003
1	39.1	35.8	40.2	36.4	35.5	36.9	41.8	42.6	38.1
2	32.1	40.4	25.0	34.4					
3	31.3	34.3							

In most years of this survey we observed flocks in Alaska Peninsula lagoons consisting mostly of light-brown Steller's eiders, usually with relatively small numbers of birds with adult-male-looking plumage. Chris Dau (pers. comm.), who has conducted occasional late spring surveys in lower Alaska Peninsula lagoons, stated that it is typical in late-May and early June to have Steller's eider flocks in these areas with all or nearly all brown-plumaged birds, often with a few adult-plumaged males mixed in. We suspect that the latter may be after-second-year birds not yet breeding. The majority of other flocks we see during the survey have a fairly even sex ratio, with males and females homogeneously dispersed within each flock. Most females in these flocks are very dark, with a distinct speculum, bordered by faint white bars that are usually visible in flight. Although Dau (pers. comm.) suggests that females usually do not attain this dark adult plumage until the Alternate II molt , we feel it is reasonable to assume that most of the brown birds in the late-migrating (or non-migrating) predominately brown flocks are second-year birds (based on the very small numbers of adult-plumaged males present, and our assumption that the proportion of after-second-year females not yet breeding would not be substantially higher than that of males). We have recorded and totaled estimates of the brown bird components of these flocks, and provide the results as a crude index to annual recruitment. We have not attempted to allocate this estimate according to major breeding area (Arctic Russia vs. Alaska North Slope). We have seen most of these immature birds among flocks on the lower Alaska Peninsula; at the end of the migrational procession.

The aerial survey crew since the beginning of the survey in 1992 has consisted of Bill Larned as pilot and port observer, with various starboard observers. Julian Fischer functioned as starboard observer in 2003. In an effort to minimize the effects of observer bias, only experienced aerial observers were used, the pilot intentionally maneuvered the aircraft so that the majority of larger eider flocks were on his (the pilot's) side for estimation, and observers received training in flock estimation within one week of each survey, using a computer simulation program (Wildlife Counts by John Hodges, USFWS, Juneau, AK), and aerial photographs of eider and other seaduck flocks.

This year in order to reduce aircraft gross weight during the longer flight legs, we established fuel caches at Togiak Village and Port Heiden airports. This proved to be helpful in enabling us to complete thorough coverage of our two longest flights without concern for running short of fuel.

RESULTS AND CONCLUSIONS

Habitat and survey conditions

Most of the winter of 2002-2003 was mild, with limited southward ice extent. However, in late February and March temperatures turned colder and extensive new ice was formed in the Bering Sea over what had previously been open water. During this survey in late March and early April there was nearly continuous thin and brash ice cover north of Cape Newenham, with some very narrow leads adjacent to extensive shorefast ice. There was also some ice remaining in Bristol Bay, which during this survey consisted mostly of about 5-10 km of continuous brash ice along the Alaska Peninsula shoreline from Naknek River to Cinder River Lagoon, due to the persistent cold northerly winds. There was up to 80 percent ice coverage of Egegik, Ugashik, and Cinder River lagoons during the survey flight of 8 March. Generally good survey conditions prevailed for most of the survey. Strong north winds during the flight from Bethel to Cape Newenham (Kuskokwim Bay) resulted in a somewhat abbreviated coverage there, however, very few Steller's eiders or other seaducks were present in that area, and it was mostly covered with thin new ice, which also helped reduce wave buildup. Winds were calm during the survey of Izembek Lagoons on 9 April, which was good for spotting birds, but made estimation challenging due to increased "rollup", where flocks flush in random directions and often join other flocks not yet counted. With the normal wind situation, flushing direction is more predictable, allowing its effects to be minimized by strategic coverage technique. Fortunately this problem was more of a factor with brant than with Steller's eiders.

Itinerary for 2003 survey

3/28	Flew survey aircraft from Anchorage to Bethel.
3/29	Conducted 4.0 hour survey flight covering south side of Nunivak Island
3/30-4/1	Persistent unfavorable weather kept us grounded in Bethel, finally on 4/1 we returned via airlines to Anchorage to wait out the storm system.
4/5	Flew via airlines to Bethel late PM.
4/6	Conducted 5.4-hour survey flight Covering from 40 km south of Toksook Bay to Kuskokwim River mouth.
4/7	Conducted 6.7-hour survey flight from Bethel to King Salmon, refueling enroute at Togiak fuel cache. Stayed overnight in King Salmon FWS bunkhouse.
4/8	Conducted 6.1-hour survey flight to Cold Bay, refueling at Port Heiden. Stayed overnight in Cold Bay FWS bunkhouse.
4/9	Surveyed Izembek NWR and local lagoons (flight time 2.5 hours). Tried to return to King Salmon but encountered heavy fog in Nelson Lagoon so returned to overnight in Cold Bay (flight time 1.6 hrs).
4/10	Flew to King Salmon, surveying Chignik area (south side of AK Peninsula) enroute (flight time 4.1 hrs.). Overnight in King Salmon bunkhouse.
4/11	Flew to Soldotna, surveying the Deep Creek Steller's eider wintering area enroute (flight time 2.8 hrs.). End of survey.

Steller's eider results

The 2003 unadjusted Steller's eider estimate of 77,329 is the highest annual estimate since 1998, but is still 9 percent below the mean of all 9 annual estimates (highest annual estimates) (Table 2). The 1992-2003 trend indicates a 6.1 percent annual decline (R2 = 0.72) in Steller's eider estimates (Fig. 1). The adjusted figure using numbers extrapolated from sampled portions of the survey area (77,369) is only slightly greater than the unadjusted figure, because most of the Steller's eiders were south of the sampled areas due to the early survey timing this year (Table 1). The increase from earlier years may be attributable in part at least to the early date, combined with a rapid completion of the survey during a period of brisk northerly winds when birds would not be expected to fly northward (into a headwind). By contrast, in 2002 there were southerly winds which encouraged migration flights. Satellite telemetry data from 2002 indicated that a portion of the population moved northward during the survey , and thus were probably not counted (Philip Martin, U. S. Fish and Wildlife Service, unpublished data).

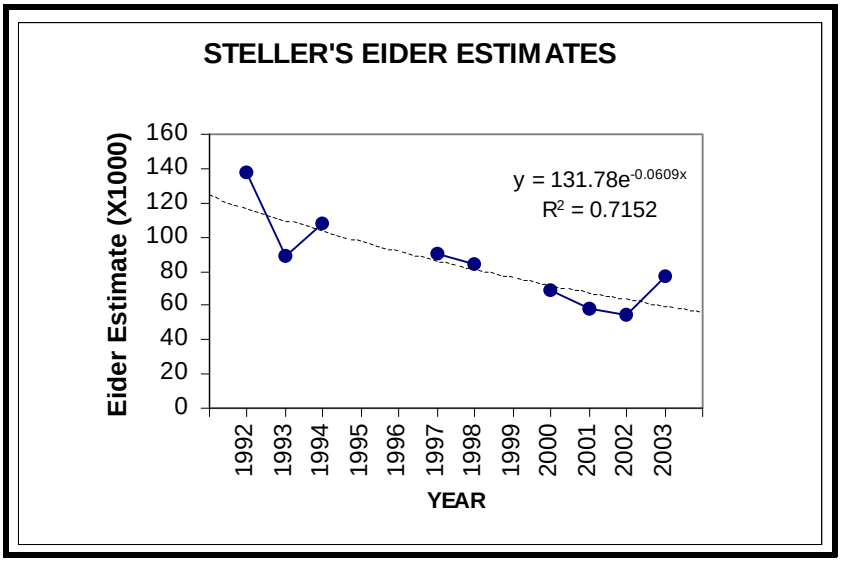


Figure 1. Trend in Steller's eider estimates from spring Steller's eiders aerial surveys, southwest Alaska, 1992-2003.

One of the assumptions of the survey is that at the time of the survey most Steller's eiders have moved into the survey area from wintering habitats outside the survey area. To investigate this assumption we therefore attempted to document departure dates of Steller's eiders from various known wintering habitats in southwestern Alaska, from the current year or at least recent years. Richard MacIntosh (pers. comm.) reported that birds were typically (recent, not current years) abundant in Chiniak Bay, Kodiak, through March, and leaving in early April, with some remaining until the 3rd week of April. In 1999, he observed a Steller's eider flock departing southwestward over the island on 17 March, and 800 birds still remaining on 18 April. Chris Hoffman (Pers. Comm.) noted that Steller's eiders observed during ground-based surveys at Dutch Harbor peaked in February during the winter of 2002-2003, with a sharp decline by late March. By April 8 he could find only a single male there. Mr. Hoffman also conducted boat surveys in the vicinity of the Homer spit this winter, and observed fairly level numbers of Steller's eiders through early March. In recent years I have observed up to 2400 Steller's eiders wintering in the Ninilchik area of lower Cook Inlet (about 1200 this past winter)(W. Larned, U. S. Fish and Wildlife Service, unpublished data). We surveyed that area briefly on 11 April and observed no eiders. During aerial surveys conducted in the Alaska Peninsula and Eastern Aleutians in February and March 2000 we noted large numbers of Steller's eiders returning to Izembek and Nelson Lagoons by early March (Larned 2000a). That was a year with an early thaw, when lower Alaska Peninsula lagoons became mostly ice-free before 1 March. These lagoons had little to no ice cover during the winter of 2002-03. We found no Steller's eiders when we surveyed the Chignik and Chignik Lagoon area on 10 April 2003. This area is known to winter Steller's eiders and held approximately 1,000 eiders when surveyed in February 2000

(Larned 2000a). While spotty and inconclusive, in aggregate the above data support the assumption that most Steller's eiders wintering in Southwest Alaska were present within the survey area during the 2003 survey.

In 1998, we classified 12,922 birds, or 15.3 percent of the Steller's eiders observed, as second-year birds based on plumage characteristics (Larned 1998). In 2000, we observed no flocks containing a predominance of brown-plumaged birds, suggesting minimal recruitment for the 1999 breeding season. In 2001, we recorded 4,553, or 8 percent of the total 58,231 Steller's eiders observed, as second-year. Most of these birds were in flocks consisting mostly of brown-plumaged birds, but also containing several birds that had plumage characteristics of adult males (white wings and heads). In 2002 and 2003, we did not record any obvious second-year flocks, though a few flocks in the southernmost portions of the survey area had a preponderance of brown birds. Elsewhere, Most flocks observed had approximately even sex ratios and adult plumage characteristics (females were dark brown with distinct white wing specula). However, at least 80 percent of the 353 eiders observed in the Kuskokwim Bay shoals area (the furthest north birds) were males. We did not note sex ratios skewed toward males during migration on previous surveys.

The pattern of habitat use by concentrations of eiders was similar to that seen during previous years' surveys. Most of the Steller's eiders were located within the lagoons along the Alaska Peninsula this year (Fig. 6), primarily in large dense flocks. We succeeded in obtaining photographs of 9 flocks in which at least most of the males could be counted. Results indicated a strong and consistent tendency to underestimate numbers, similar to that noted in the photo check conducted in 1998. However, the sample this year was small and biased toward large, very dense flocks, so we did not attempt to correct for observer bias using these data. Suffice it to say that we believe this survey in general underestimates the number of Steller's eiders in the survey area, but the 100 percent consistency in primary observer should result in reasonably comparable bias among years.

King eider

This year the early timing of the survey caught a large number of these early migrants still in the Kvichak/Nushagak shoals area, which is a major staging area for adults (Table 1, Fig. 7). Extrapolating sampled observations, we estimated 84,463 king eiders in the Kvichak Shoals area and 10,312 at Cape Constantine. We also made an independent estimate of 101,658 of a cluster of king eider flocks in the middle of Kvichak Bay. This estimate was not included in the totals reported in tables 1 or 2, but the cluster was sampled by the transects used in the tabulated estimates above. These flocks were extremely large and difficult to estimate. As noted in previous years' reports, most of the flocks encountered along the Alaska Peninsula (9,659 total birds) consisted of birds in immature plumage. The tendency of king eiders to often feed and migrate far offshore, their occurrence in large variable-density flocks, and their early and protracted migration makes it impossible to draw meaningful conclusions from year-to year comparisons of estimates. The important thing to note is the persistent use and apparent importance of staging areas, especially in Kvichak Bay (adults) and along the Alaska Peninsula (young birds).

Other waterfowl

Table 1 lists 2003 results for seaducks, brant and emperor geese by geographic area, with expanded estimates for the four sampled areas. Table 2 lists highest annual survey totals for all species for all survey years since 1992. Figures for 2003 are unexpanded in Table 2 to facilitate comparison among years, so do not agree with those in Table 1.

The distribution of other species is typical of a relative early survey with extensive ice cover in northern portions of the survey area: most were encountered along the Alaska Peninsula and in upper Bristol Bay.

CONCLUSIONS AND RECOMMENDATIONS

Although this survey is admittedly a rough census of a "moving target" of birds actively migrating northward, with no statistically-valid measure of precision, our confidence in the developing downward trend increases as the annual estimates accumulate. Caution dictates that we proceed carefully and attempt to refine our methods and/or develop another independent measure of trend.

ACKNOWLEDGMENTS

I gratefully acknowledge the assistance of the managers and staffs of Alaska Peninsula/Becharof, Izembek, Togiak, and Yukon Delta National Wildlife Refuges, who provided for the logistic needs of the survey crew. Further assistance was provided by Refuge Information Technician Pete Abraham, who helped us set up and access our fuel cache in Togiak Village, and DOT airport manager Mark Welborne, who likewise helped us out at Port Heiden. I also sincerely appreciate the help of starboard observer Julian Fischer, who performed his task competently and enthusiastically.